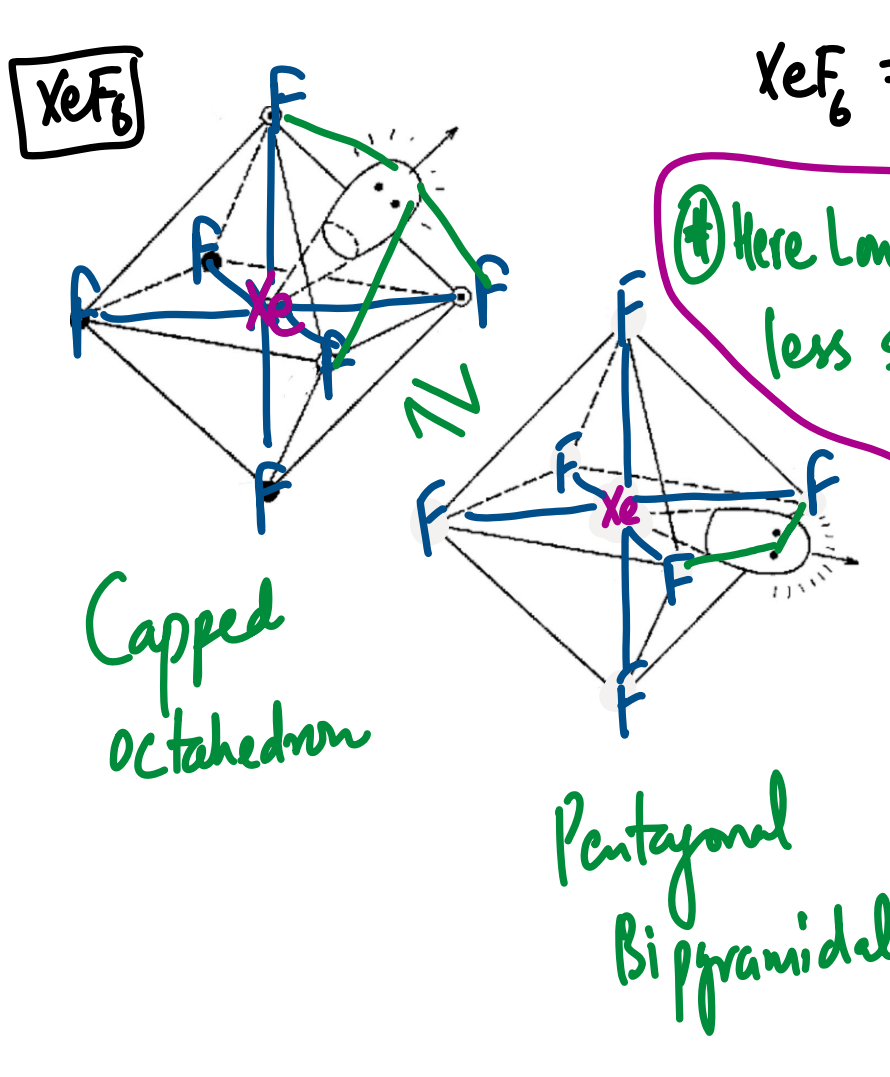
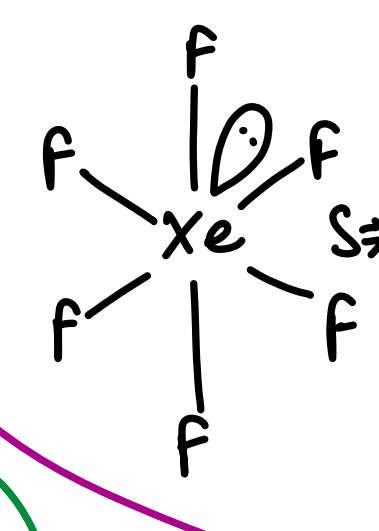
Bonding sep 26 part 2

Sunday, September 25, 2022 8:12 AM

XeF_6



$XeF_6 \Rightarrow \frac{8+6}{2} = S\cdot N = 7 = 6+1 = sp^3d^3$



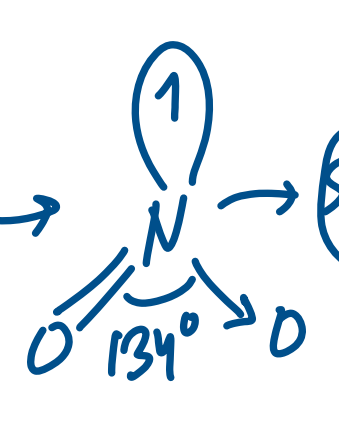
G = PBP

S ⇒ Distorted octahedron

① Here Lone pair occupy less space than Bond pair. → Exception of VSEPR

Fluxional Behaviour
- → Non-rigidity
- → Both forms interchange into each other

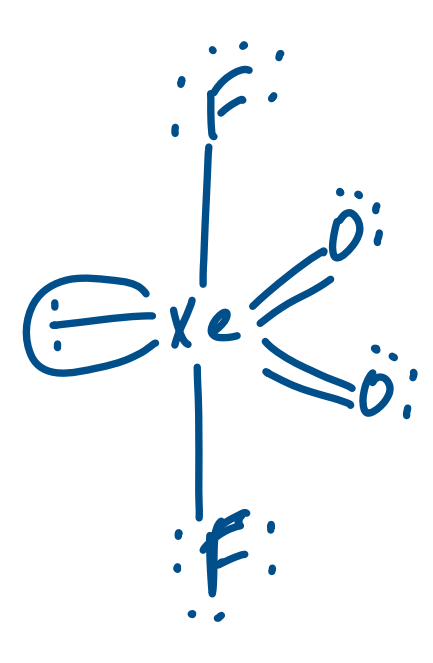
We cannot find Hybridisat^n by above discussed Calculations for odd e^- species eg:- ClO_2, NO_2



→ sp^2 like

XeO_2F_2

$S\cdot N = \frac{8+2}{2} = 5 = 4+1$ ↳ sp^3d



Total L·p = 11

G = TBP

$\boxed{\cos\theta = \frac{p-1}{p}}$ ⇒ for sp, sp^2, sp^3

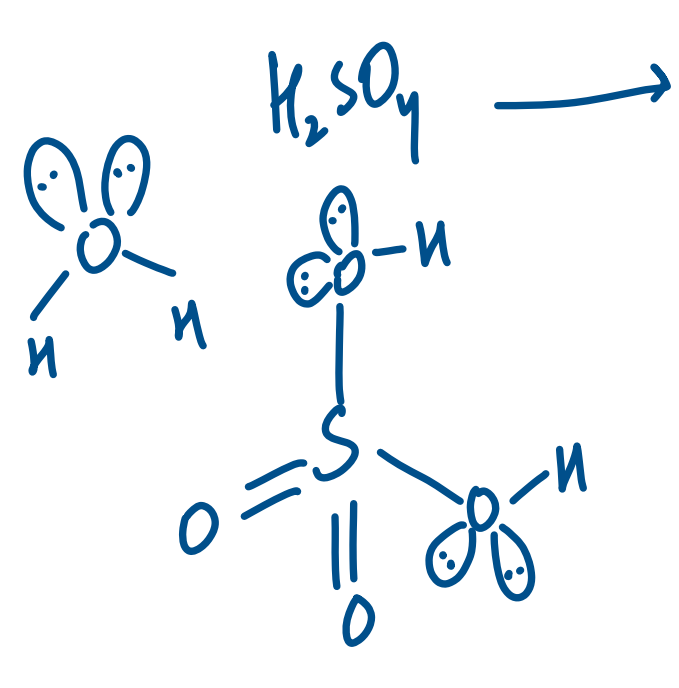
Oxygen without formal charge ⇒ 2 Bonds + 2 L·p
Oxygen with −1 formal charge ⇒ 1 Bond + 3 L·p
Oxygen " +1 " " ⇒ 3 Bond + 1 L·p

Structures of oxoacids of P, S, N, Halogen, Carbon

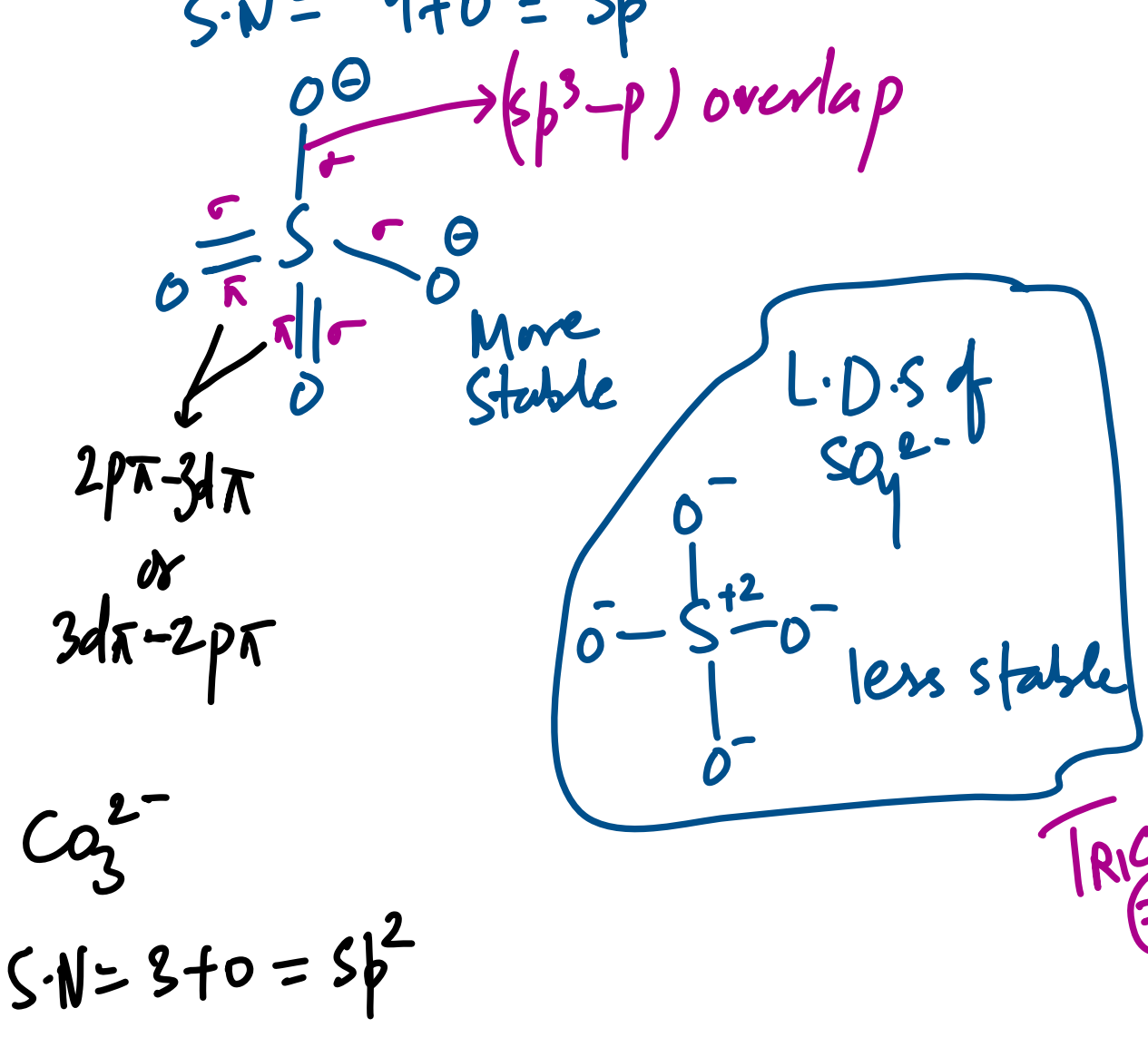
→ Acid that can give H^+ connected with oxygen

To draw str;
Remove H^+ from Acid & find Hybridisation of Anion Having single center

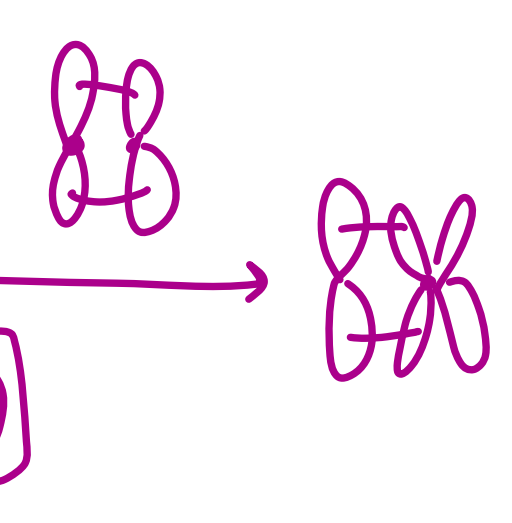
$H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$



$S\cdot N = 4+0 = sp^3$

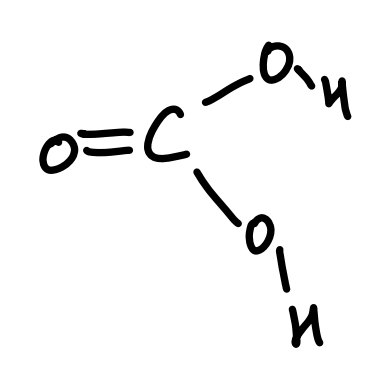


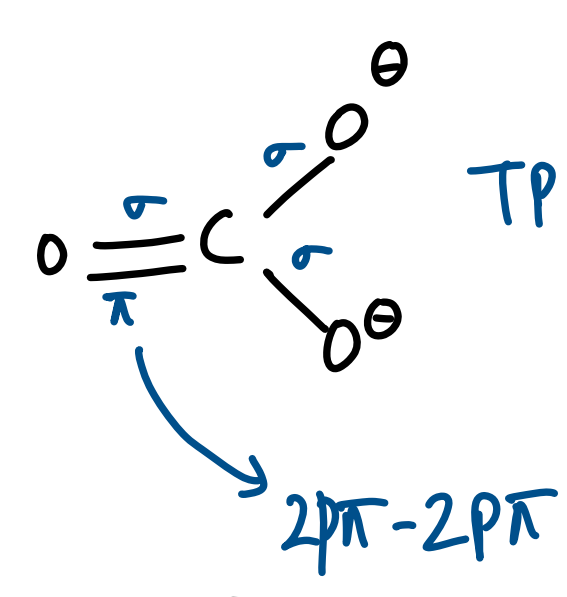
π Bond only from overlap of atomic orbital
1) pπ - pπ →
2) pπ - dπ →
3) $\boxed{d\pi - d\pi\ (\delta\text{ Bond})}$ → b/w d-metals



$H_2CO_3 \longrightarrow 2H^+ + CO_3^{2-}$

$S\cdot N = 3+0 = sp^2$





TP = G = S

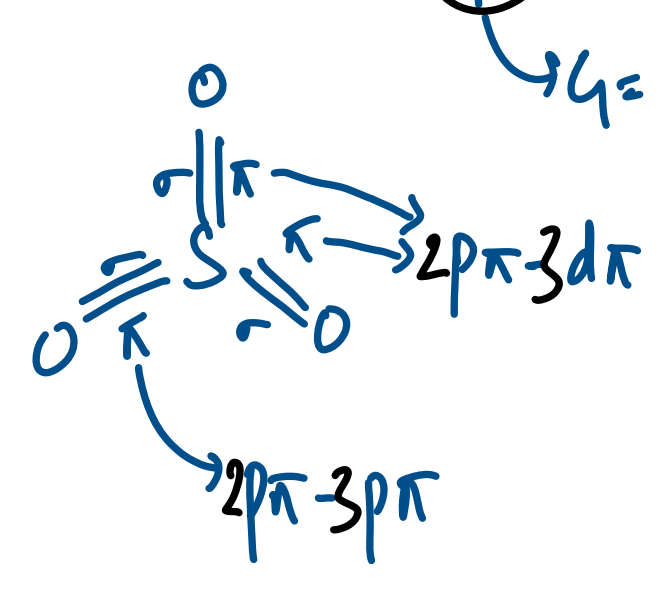
TRICK # To predict type of π- Bond

sp ⇒ all π ⇒ pπ-pπ

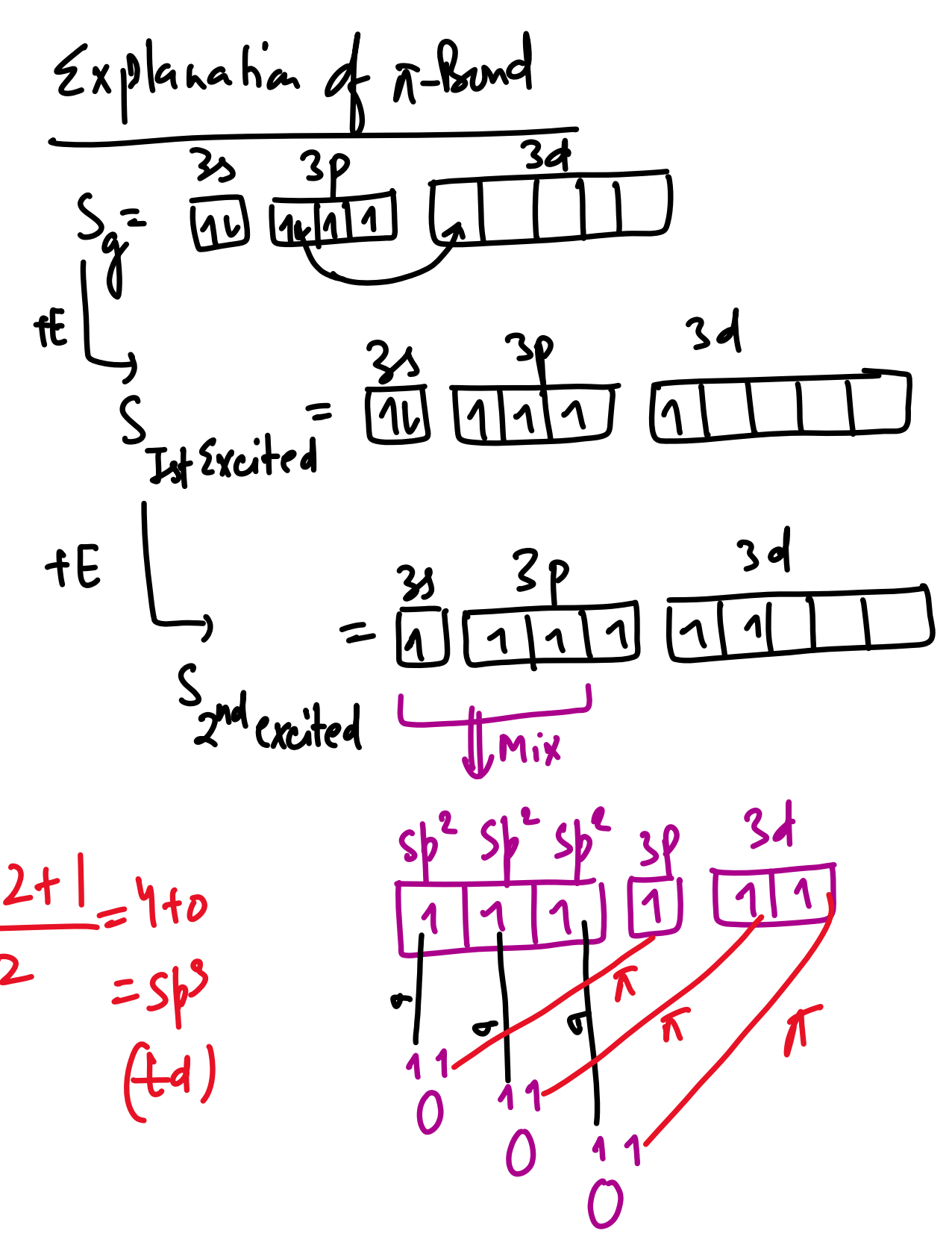
sp^2 ⇒ first π ⇒ pπ-pπ & Rest π ⇒ pπ-dπ

$\boxed{sp^3, sp^3d, sp^3d^2, sp^3d^3}$ → All π → pπ-dπ

$SO_3 \Rightarrow S\cdot N = 3+0 = sp^2$ → G = TP = S

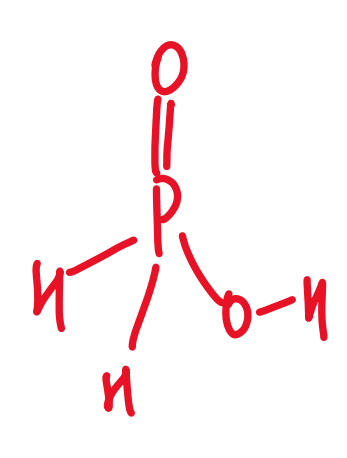


Explanation of π-Bond

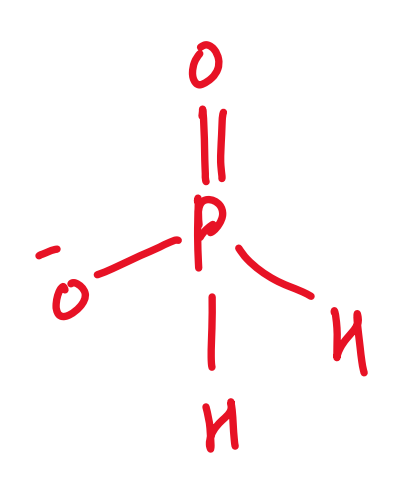


Exceptional Acids

a) H_3PO_2 → give only $\boxed{1\ H^+}$



$\boxed{H_2PO_2^{\ominus}}$ → $S\cdot N = \frac{5+2+1}{2} = 4+0 = sp^3$ (td)

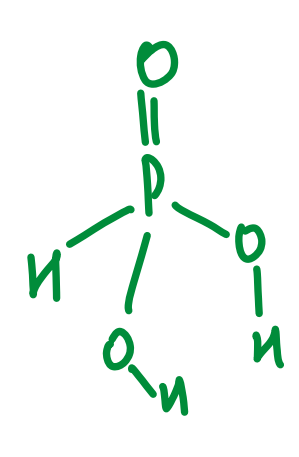


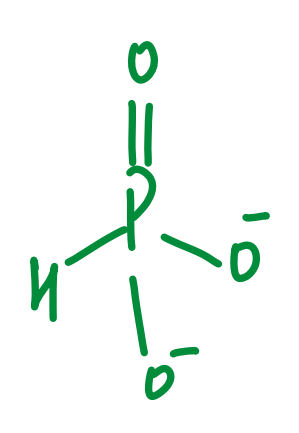
H.W → HNO_3, H_2SO_3, HNO_2, H_3PO_4.

b) H_3PO_3 ⟶ give only $2H^{\oplus}$

$H_3PO_3 \longrightarrow 2H^+ + \boxed{HPO_3^{2-}}$

$S\cdot N = 4+0 = sp^3$





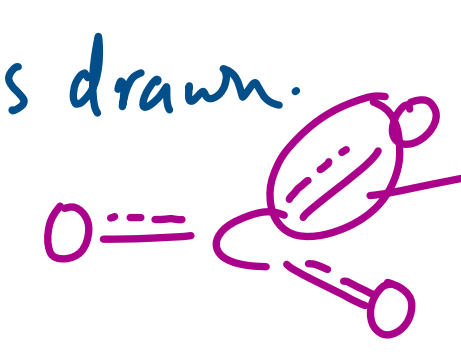
RESONANCE :-

* Phenomenon in which e^- density delocalises (move) within the molecule due to which more than 1 L·D·S or structure can be drawn for any molecule or species.
Such Structures are imaginary or hypothetical forms & called Resonating structures (R.S) or CANONICAL FORMS.

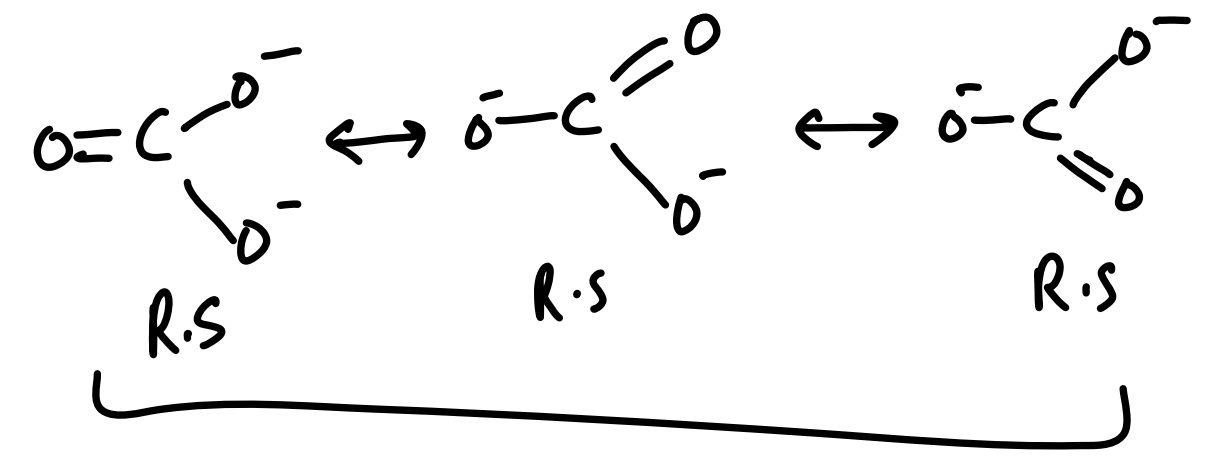
⊛ Resultant of all these R.S is called Resonance Hybrid (R.H). All the physical properties are predicted by R.H only.
→ like Bond Angle, Bond length, Bond strength, Bond energy, Bond order, m.p etc.

⊛ In Resonance, Atom never moves only e^- density moves.
⊛ B/w two R.S, "⟷" is drawn.

eg of CO_3^{2-}

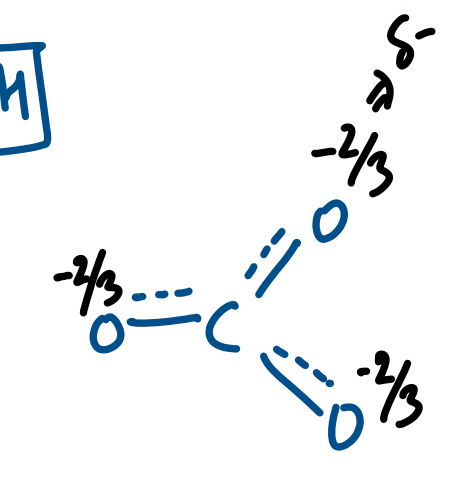


$1 + \frac{1}{3} = \frac{4}{3} = 1.33$



Identical R.S

$\boxed{R\cdot H}$



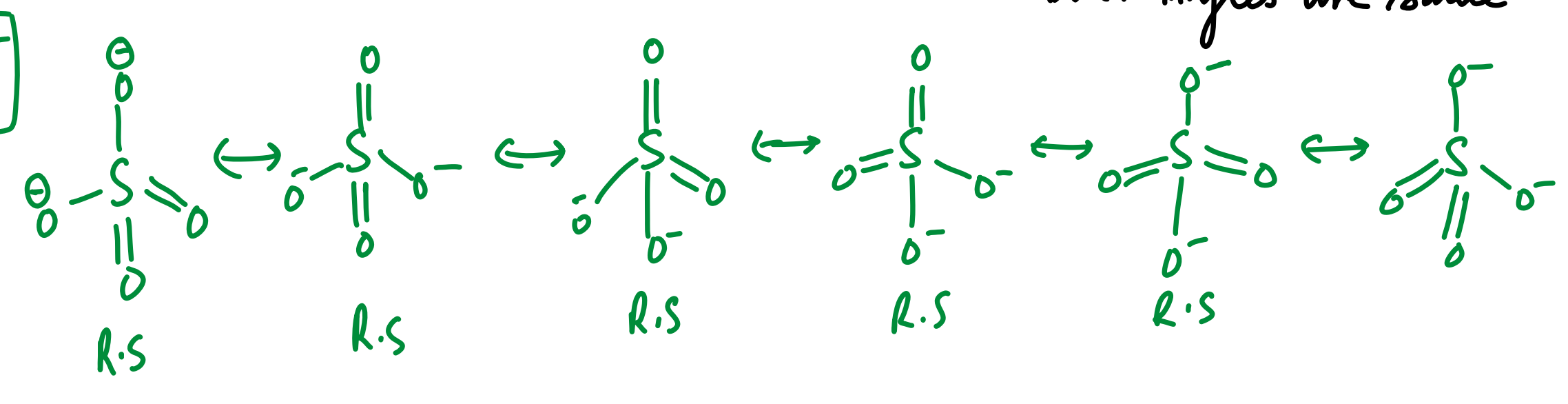
$B\cdot O\ (C\text{-}O) = \frac{\text{Total Bonds b/w } C\ \&\ O}{\text{Total } \sigma \text{ b/w } C\ \&\ O} = 4/3$

Bond order (C-O) $= 1 + \frac{1}{3} = 4/3 = \boxed{1.33}$ ⇓ Represents Partial double Bond

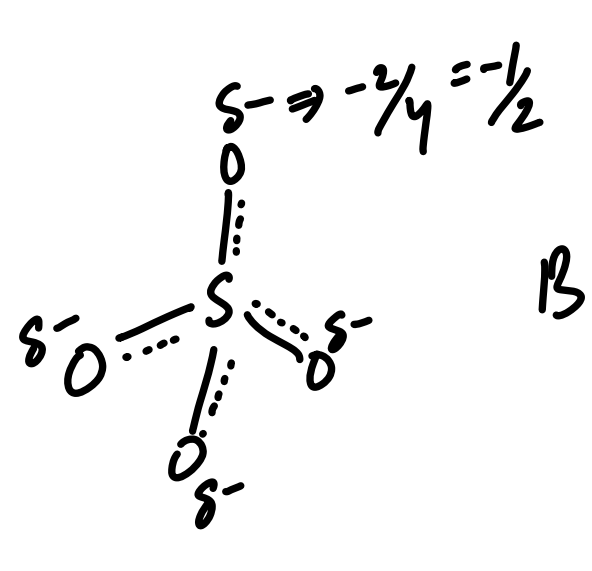
$|\delta| < 1$

⊛ All C-O Bonds are of same strength & length
⊛ All Bond Angles are same

$\boxed{SO_4^{2-}}$

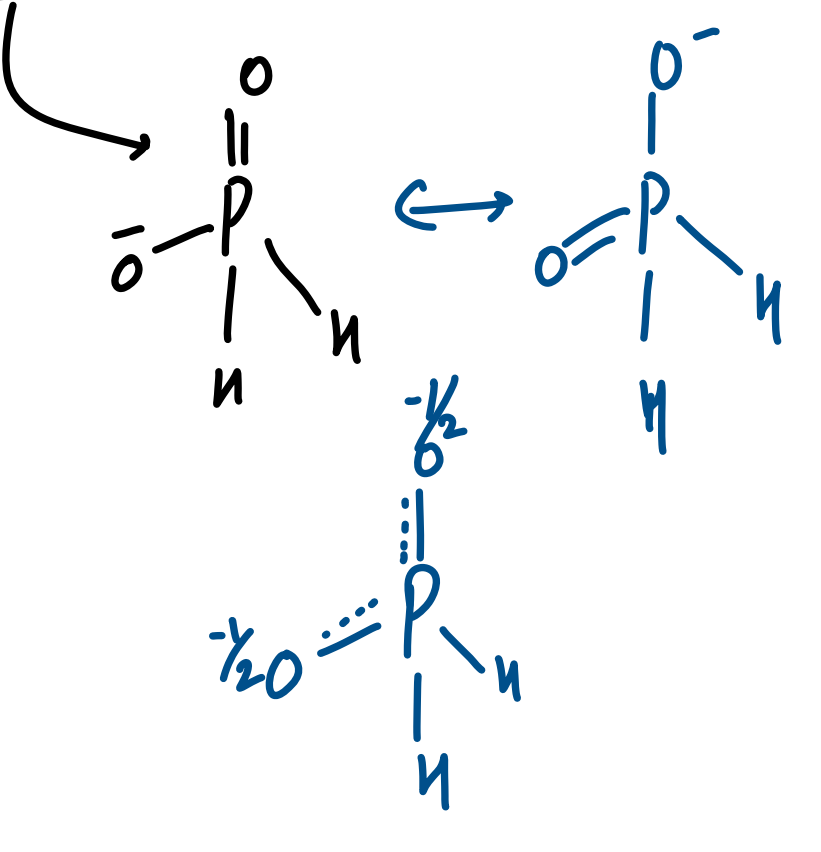


Total 6 R.S



$B\cdot O(S\text{-}O) = 1 + \frac{1}{2} = 3/2$

H.W NO_2^-, NO_3^-, $\boxed{H_2PO_2^-}$, HPO_3^{2-}, PO_4^{3-}.



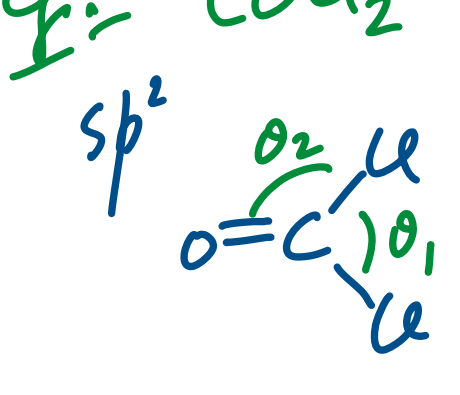
$\boxed{B\cdot O(P\text{-}O) = 3/2}$

VSEPR Continued...

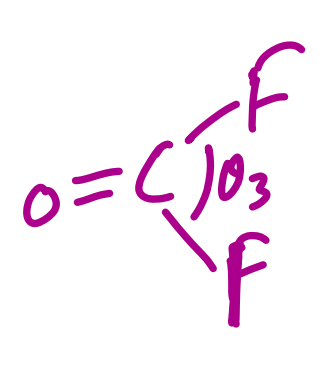
⑤ Double Bond occupy more space than single Bond, so repul^n of

$\boxed{d\cdot B\text{-}d\cdot B > d\cdot B\text{-}S\cdot B > S\cdot B\text{-}S\cdot B}$

eg:- $COCl_2$ COF_2



$\theta_2 > \theta_1$

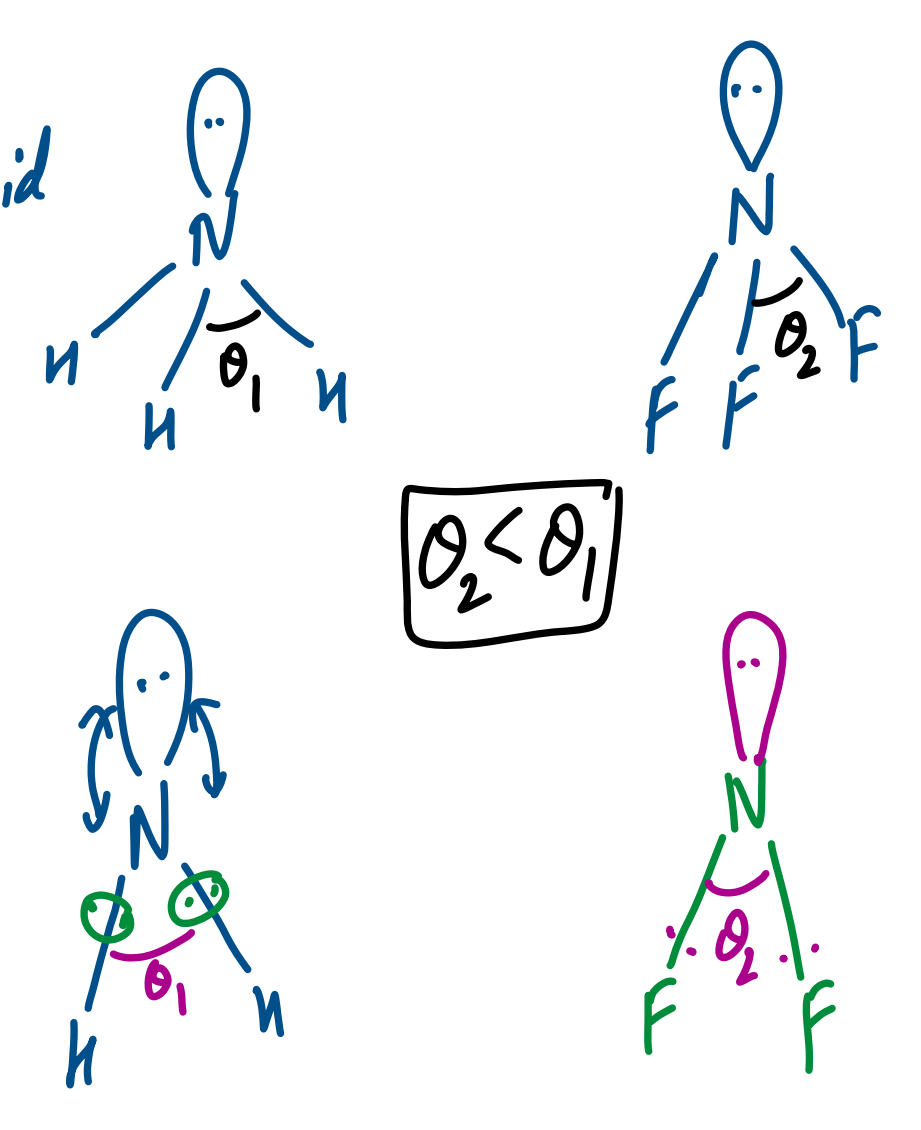


$\boxed{\theta_1 > \theta_3}$ → Because Cl atoms have Bigger Size

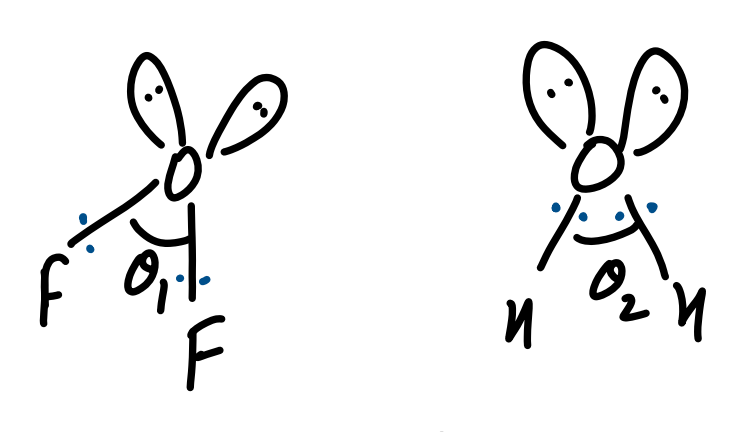
⑥ Rule I :- Keeping Center atom same (must have L·p) if electronegativity of surrounding atom ↑es, Bond Angle ↓es.

eg of i) NH_3 $sp^3 = 3+1 = 4$ NF_3 $sp^3 \Rightarrow 3+1 = 4$

G = td
S = pyramid



ii) OF_2 $2+2 = 4 = sp^3$ H_2O $2+2 = 4 = sp^3$



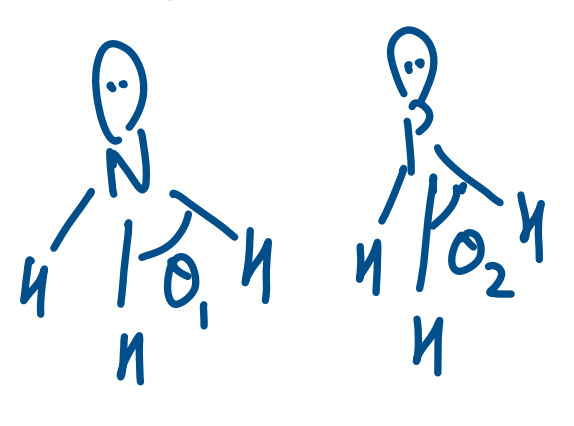
$\theta_1 < \theta_2$

Space b/w Bond pairs in NF_3 is more compared to NH_3

Rule II :- Keeping Surrounding Atom same; More is the electronegativity of center (must have L·p), more will be Bond Angle.

eg 1) $\overset{107°}{NH_3} > \overset{94°}{PH_3} > \overset{93°}{AsH_3} > \overset{92°}{SbH_3} > \overset{91°}{BiH_3}$

2) $\overset{104.5°}{H_2O} > \overset{93°}{H_2S} > \overset{92°}{H_2Se} > \overset{91°}{H_2Te}$ → why large diff?



$\theta_1 > \theta_2$

Q Why there is large diff in Angle b/w NH_3 & PH_3?

Both Rules (I & II) only valid if there is no BACK Bonding in Molecule.